a statement of his views as to the aim and end of technical training. Mr. Day pointed out the value of the association of the work of the science side of the institute with the study of the artistic crafts and with the bearing of science upon design. It was, in his opinion, of great value to develop so far as possible a more intimate association than ordinarily exists between different branches of teaching, so as to familiarise the craftsman with the methods, the aims, and the applications of science. Previous to the distribution of the prizes, Mr. George Baker, chairman of the institute committee, in reporting on the work of the past session, referred to the fact that the prizes that had recently been presented to the institute by the Goldsmiths' Company for the department of metallurgy had been awarded for the first time. The first of these prizes was given for the best piece of research work carried on in the department of metallurgy during the past session, and he recorded with great interest that three very satisfactory investigations had been done during that period.

THE issue of the *Oxford and Cambridge Review* for the Michaelmas term contains an unusually large number of articles dealing with subjects connected with higher education. Dr. F. C. S. Schiller discusses exhaustively the whole question of scholarships at the public schools and the universities under the title of "Eugenical Scholarships." The particular title adopted is justified, because the thorough examination of recent proposals to restrict public scholarships to the children of poor parents leads up to a consideration of the matter from the point of view of eugenics. Intelligence and ability, says Dr. Schiller, are hereditary; the probability of getting able children is vastly greater if they spring from able parents; intelligence and ability lead to success among professional men; for men so situated the institution of scholarships is simply invaluable, since it acts as a great eugenical inducement, and is calculated to augment the supply of valuable citizens. Mr. R. J. MacKenzie, late rector of Edinburgh Academy, in an article on school examinations, points out how the multiplicity of examining bodies all examining for similar purposes leads to waste of time, money, and energy in secondary schools, and pleads for a universal "secondary-schools' leaving examination" for England and Scotland. The same issue of the *Review* contains an essay entitled "The Idealistic Interpretation of Prof. Ostwald's Theory of Energy," by Mr. J. Butler Burke, and articles on other educational matters.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 25.—"Dichloro-urea." By Dr. F. D. **Chattaway**, F.R.S.

There is probably no substance among the almost bewildering number known to chemists which surpasses urea in interest, or which has been more frequently and carefully investigated. It has been so much studied from almost every point of view that a new simple derivative was scarcely to be expected. Such a new simple derivative is, however, found in the recently discovered chlorine substitution product.

This is produced when chlorine is passed into a cooled saturated aqueous solution of urea. Action takes place without any considerable development of heat, and a compound crystallises out in which two of the four hydrogen atoms of the parent substance are replaced by halogen. Dichloro-urea obtained thus is a soft, white crystalline powder, consisting of thin transparent plates, which can be preserved for a considerable time in a dry atmosphere, although, as might be expected, it is not very stable.

Having regard to its composition and mode of formation, as well as to the structure of urea itself, its constitution must be represented by the formula

$$\mathrm{Cl}>\mathrm{N}-\mathrm{CO}-\mathrm{N}<\mathrm{Cl}$$

which explains its formation and such of its reactions as have yet been studied. From this structure, and the fact that heat is absorbed when it is formed, it might be expected to be highly explosive. When heated, however, it does not itself explode, but decomposes at about 83° C. with liberation of the vapour of nitrogen chloride. The latter, if it is not allowed to escape, and if the temperature is raised a few degrees higher, detonates with great violence.

Dichloro-urea is a compound of a marked acid character; it has a sour taste, recalling that of hypochlorous acid, and its aqueous solution strongly reddens litmus paper, which only becomes bleached after the lapse of some minutes. It acts very corrosively upon the skin, staining it yellow and destroying the tissues, and gives all the reactions characteristic of compounds in which chlorine is directly attached to trivalent nitrogen. It is distinguished from most other substances belonging to this class of compounds by the readiness with which it is hydrolysed, nitrogen chloride, carbon dioxide, a little nitrogen, and ammonium chloride being produced.

Dichloro-urea is instantaneously decomposed by a solution of caustic potash, two-thirds of the contained nitrogen being liberated as gas with violent effervescence, while the remaining one-third appears as ammonia, which, together with the alkaline carbonate also formed, remains dissolved in the liquid.

This behaviour of dichloro-urea gives an insight into the course of the reaction which occurs when urea is decomposed by an excess either of alkaline hypochlorite or hypobromite. This decomposition, which has received an extraordinary amount of attention, as it furnishes a quick though not very accurate, method of estimating the quantity of urea present in a liquid, has never been properly explained, and is generally represented by an equation which makes it appear to be a case of oxidation. Dichloro- or dibromo-urea or some analogous compound is without doubt formed as an intermediate product, the action being thus one of halogen substitution followed by decomposition of the substituted urea by the excess of alkali present.

It may be noted that dichloro-urea is safe to handle, and promises to be of considerable use as a synthetic agent.

Royal Astronomical Society, December 11.—Mr. H. F. Newall, F.R.S., president, in the chair.—The determination of the apparent diameter of a fixed star: Major P. A. **MacMahon**. But little certainty is to be attached to existing estimates of the diameters of fixed stars, and a direct method, independent of the star's parallax, is much to be desired. The author proposed to apply the principle of the bioscope to the photography of occultations of stars by the moon. It was shown that a star might have an apparent diameter of 1/100oth of a second, and that the time taken by the moon to occult a fairly bright star might give an approximate measure of such a diameter. Prof. Dyson said he entirely agreed with the principle of Major MacMahon's method, and hoped that results might be obtained in the case of bright stars occulted by the dark limb of the moon. It would be necessary to employ a reflecting telescope of large aperture, and extremely sensitive plates.—The **Astronomer Royal** showed further photographs of comet *c* 1908, Morehouse, in continuation of the series exhibited at the last meeting, carrying the record to November 25, after which the moon interfered, and the comet got too low. The structure of the tail still showed detail of great interest, including the apparent dark rifts, though the cyclical changes seen in September and October did not appear to continue. A further series of photographs of the comet, taken by Prof. Barnard at the Yerkes Observatory from October 16 to November 19, was also shown.—The comet of 1556: its possible breaking up by an unknown planet into three parts, seen in 1843, 1880, and 1882: Prof. George **Forbes**. The three latter comets formed a group, closely related to each other, and the author gave his reasons for considering that the disruption of the comet of 1556 occurred through the influence of an ultra-Neptunian planet, which his calculations showed to exist at a mean distance from the sun of about 100 celestial units, with a period of about 1000 years and an inclination to the ecliptic of about fifty degrees. Some search had been made for the supposed planet, but only in the region of the Zodiac, so it was not surprising that the results had been negative.—An

improved telescope triple object-glass: J. W. **Gifford.** The method and formulæ for figuring and testing were described and illustrated.

Royal Meteorological Society, December 16.—Dr. H. R. Mill, president, in the chair.—Some forms of scientific kites: Eric S. **Bruce.** Some forms of scientific kites were described other than the well-known box-kite invented by Mr. Hargrave. This is heavier and more breakable than many other forms of kites, but it possesses the indisputable advantages of stability, ascending steeply and exerting great force. When there is wind enough to fly it, it would appear unsurpassed. It is, however, advisable that meteorological kite ascents should be carried out as continuously as is possible, and that as many as possible of those days when the heavier box-kite will not rise should be utilised for obtaining information. On this account Mr. Bruce considers that lighter forms of kites, which are specially adapted for use in very light winds, would be of great service. He then described the Brogden six-winged bird-kite, the Salmon eighteen-winged kite, the Barclay honeycombed-kite, the Cody bat-winged box-kite, the Balston butterfly-kite, and the Burgoyne aluminium kite.—The registering balloon ascents in the British Isles, July 27 to August 1, 1908: C. J. P. **Cave.** These ascents were made in connection with the extended series of ascents of kites and balloons arranged by the International Commission for Scientific Aëronautics. Some of the records show considerable differences of temperature between the up and the down traces, which seems to indicate that fairly rapid fluctuations of temperature may occur in the upper air. The average height reached was 10·2 miles, the greatest height being 14·3 miles. All the balloons except one reached the isothermal layer, and show that the diminution of temperature with height ceases after a certain point, or that there is a rise of temperature; the rise of temperature is quite marked, even in the case of balloons which have attained their highest point after sunset, and cannot, therefore, be the effect of solar radiation.—Balloon observations at Ditcham Park, near Petersfield, July 27 to August 2, 1908: C. J P. **Cave.** The registering balloons which were sent up were followed by means of theodolites for the determination of wind velocities at different heights. The balloons were observed until after they had entered the isothermal layer, and in each case there was a well-marked diminution of wind velocity at its lower limit.

DUBLIN.

Royal Irish Academy, December 14.—Dr. F. A. Tarleton, president, in the chair.—Extensions of Fourier's and the Bessel-Fourier integral theorems: Prof. W. McF. **Orr.** Hankel's fundamental equation is obtained with an extension to functions of any order, real or complex; the parameter is regarded as complex, the ordinary line integral from zero to infinity being replaced by one taken along a contour in which the limits of the parameter are a positive and a negative infinity. This is done by first obtaining equivalent equations in the K functions, the contour being deformed into one everywhere at infinity; along this each function may be replaced by the dominant term in its asymptotic expansion, and when this is done the required results follow by Fourier's integral theorem. Precisely similar theorems are obtained in which the Bessel functions are replaced by their derivatives of any, but the same, order. Expansions are obtained suitable for the discussion of vibratory motion in the space outside a sphere or an infinite cylinder; for example, an arbitrary function of r is expressed, for values $>a$, by an integral the element of which is a multiple of

$$\{J_n(\lambda r)J_{-n}(\lambda a) - J_{-n}(\lambda r)J_n(\lambda a)\}d\lambda.$$

The author believes that the investigations are valid for functions which satisfy Dirichlet's conditions, and for no others.

NEW SOUTH WALES.

Royal Society, October 7.—Mr. W. M. Hamlet, president, in the chair.—The influence of infantile mortality on birth-rate: G. H. **Knibbs.** It is shown from the statistics of all countries furnishing accurate statistics that:—(1) For any one country uniform increments to the rate of infantile mortality tend to produce uniform increments in the birth-rate; that is to say, the birth-rate β_0, which would correspond to an absence of infantile mortality, is given by the equation $\beta_0=\beta-b\mu$, where β is the actual birth-rate, μ the rate of infantile mortality, and b a constant peculiar to each community or country. (2) The coefficient showing the influence of infantile mortality on the birth-rate as actually deduced is in all cases very small. (3) No general law exists for the world as a whole. (4) The constant b does not appear to be influenced by the magnitude of the birth-rate itself, since it is approximately the same for a country with a low birth-rate (such as France) and a high birth-rate (such as the Netherlands). (5) That the *a priori* tendency of increase of birth-rate through increased rate of infantile mortality may be masked by other influences.

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